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ABSTRACT

A study compared language skill development and cultural attitudes of second-grade children taught in an additive-bilingual program setting with those of second-grade children from a monolingual classroom setting. Subjects were 41 second-grade children participating in a Spanish immersion program and 19 children from a regular second-grade classroom. Comparisons were made on three variables: (1) nonverbal problem-solving, as measured by a test using progressive matrices; (2) native language development, as measured by a picture vocabulary test; and (3) attitude toward Hispanic culture, as measured by a cross-cultural attitude inventory. Gender and age relationships were also examined. Results supported earlier research and theory on the mediation of language as an essential part of nonverbal problem-solving, on the positive effect of second-language learning on cultural outlook, and on the contribution of the additive-bilingual instructional setting to native language maintenance in immersion education. 62 references. (MSE)

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Cognitive and Attitudinal Outcomes of an Additive-Bilingual Program

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Abstract

Children in an additive-bilingual setting may demonstrate enhanced nonverbal problem solving ability, maintenance of native language skills and positive attitudes when compared to monolingual peers. Subjects in this study were 41 grade two children (18 boys and 23 girls) participating in a Spanish-immersion program and 19 children (11 boys and 8 girls) from a standard grade two classroom. Program was the independent variable in three comparisons. Nonverbal problem-solving was the dependent variable in the first comparison, as measured by Raven's *Coloured Progressive Matrices* (CPM). A repeated-measures ANOVA of the results of fall and spring administrations indicated significant differences in favor of the Spanish-immersion group, F (1, 35) = 5.58, $p < .05$. In the second comparison, native-language development was the dependent variable as measured by the *Peabody Picture Vocabulary Test-R* (PPVT-R). An analysis of covariance was performed on the fall and springs results, with outcomes of the CPM, gender and age as covariates. No significant differences between the standard- and immersion-program groups were found, $p > .05$. Finally, attitude toward the Hispanic culture as measured by the *Cross-Cultural Attitude Inventory* (CCAI) was the dependent variable. A repeated-measures MANCOVA was performed on the fall results of the CCAI with gender, age, and the results of the PPVT-R as covariates. A significant effect was shown in favor of the immersion classroom, F (3, 107) = 48.02, $p < .05$. In the spring, a repeated-measures ANOVA also revealed significant differences, F (1, 56) = 8.80, $p < .05$, in favor of the immersion group. Results were interpreted to support Vygotsky's (1978) assertion that the mediation of language is an essential part of nonverbal problem-solving. In terms of attitudinal outcomes, Gardner's (1983) model of second-language acquisition was supported. Findings regarding native-language development supported Lambert's (1984) concept of "additive-bilingual" settings.

The idea that language study may enhance an individual's general cognitive abilities has intrigued philosophers and psychologists for more than two thousand years. Research into the relationship between bilingualism and cognition in the first half of the twentieth century seemed to contradict that popular belief through the large scale testing of bilingual immigrant groups. Contemporary researchers, however, now point to the inadequate designs of early attempts to measure the effect of bilingualism on cognition (for a review see Hakuta & Diaz, 1986). Since 1962, quasi-experimental studies of the relationship between bilingualism and cognition have revealed that children in additive-bilingual settings demonstrate no intellectual retardation. Further, as Cummins (1976) pointed out, taken as a whole a large body of data from additive-bilingual programs in Canada and the United States has been interpreted to indicate that under certain conditions bilingualism may enhance certain cognitive skills. Further, children in such settings demonstrate maintenance of native language skills and positive attitudes toward the second language community. However, the quasi-experimental design of the studies, the lack of research in settings isolated from the second-language community, and the social significance of the question in a time of rapid immigration into the United States all call for further research.

Nonverbal Problem Solving

Efforts to construct a theoretical explanation of the relationship between bilingualism and cognition in the last quarter century have

focused on the bilingual child's precocious ability to separate symbol from referent, which in turn is seen as a significant step in the development of symbolic thinking. The process by which such early metalinguistic ability may enhance certain cognitive abilities is not well understood. Research looks to the enhanced control of cognitive processes among bilingual children as a factor, possibly by means of superior verbal mediation.

Hakuta, Ferdman and Diaz (1986) theorized that the special objective awareness of language demonstrated by bilingual children in studies such as those by Ianco-Worrall (1972), Ben-Zeev (1977a, 1977b) and Cummins (1978) leads to a facility for abstract and symbolic reasoning. The separation of words from referents was seen as a significant breakthrough in the development of symbolic thinking. The authors cited Vygotsky (1962) who had noted that a bilingual child would "see his language as one particular system among many, to view its phenomena under more general categories, and this leads to an awareness of his linguistic operations" (p. 110). Hakuta, Ferdman and Diaz (1986) concluded that the special metalinguistic awareness of bilingual children leads them to use language more efficiently for self-regulatory functions, thus fostering higher cognitive skills.

Metalinguistic ability is composed of both knowledge and control components, according to Bialystok (1986a). Bialystok (1986b) found that bilingual children consistently outperformed their monolingual peers in word tasks requiring high levels of control of

processing. In the first phase of the study, bilingual subjects were children being educated in an English program who were fluent speakers of a second language, and spoke that language in the home. In the second phase, bilingual subjects were children participating in a French immersion program. Thus, both bilingual groups came from settings which would be termed by Lambert (1984) as additive-bilingual in that first language skills were valued and being maintained.

Why children in additive-bilingual settings may demonstrate superior control of cognitive processing remains unclear. Vygotsky (1978) asserted, "In the solution of nonverbal tasks, even if a problem is solved without a sound being uttered, language plays a role in the outcome" (p.33). Vygotsky's essentially philosophical position subsequently received empirical support from Kirby and Das (1978) who analyzed the relationship between two subscales of Raven's *Coloured Progressive Matrices* and a number of ability tests in a study of monolingual subjects. Results indicated that while most subjects used a spatial nonverbal strategy, many of the most successful subjects used a verbal strategy. Children in an additive-bilingual setting , as Lambert (1984) pointed out, demonstrate continued growth of the native language in addition to second language acquisition. As long as the native language continues to develop at an age-appropriate level, the bilingual child has linguistic resources for verbal mediation. The acquisition of a second language, then, would provide additional

linguistic resources as well as an objectification of language that may enhance control of cognitive processing.

Continual evaluations of the St. Lambert immersion program (see Bruck, Lambert & Tucker, 1974; Lambert & MacNamara, 1969; Lambert & Tucker, 1972; Lambert, Tucker and d'Anglejan, 1973) have provided longitudinal data on the effects of bilingualism on cognition. Bruck, Lambert and Tucker (1974) reported that at grade 6 the pilot immersion group outperformed controls on a test of divergent thinking as a measure of cognitive flexibility. Further, in a statistical analysis of changes in flexibility measures from first to sixth grade the pilot group showed significant gains over controls. The next year, the sixth grade follow-up group outperformed controls on the *Embedded Figures Test*, cited by the authors as a measure of cognitive flexibility.

Students enrolling in the St. Lambert immersion program were self-selected, and thus they may have differed in important ways from the children in the monolingual control groups. However, Lambert and Tucker (1972) noted that there was no significant difference between the experimental and control groups on Raven's *Progressive Matrices* administered as a pretest of intelligence at the beginning of grade one. Further, as space was limited in the experimental program, many members of the English control group may have been students who would have enrolled in the immersion programs if given the option and thus were felt by Lambert and Tucker (1972) to resemble immersion students.

The superiority of the immersion students emerged at the same time Lambert (1978) assessed the children to be functionally bilingual. Here apparently, was empirical support for the impact of bilingualism on cognition, although Lambert (1984) later cautioned that the results should only be considered suggestive because of the small sample sizes involved.

The longitudinal results of the St. Lambert program were not replicated by Barik and Swain (1976a) in a subsequent study in Ontario. Over the course of grades 1 to 3, immersion students did not outperform controls in either overall IQ or subtest scores. However, when further analysis separated immersion students into high and low French achievement groups, the high French achievers obtained both higher IQ measures and subtest scores than the low achievement group even subsequent to adjusting the data for differences in initial age and IQ.

Cummins' (1976, 1978, 1987) threshold theory of the relationship between bilingualism and cognition was cited by Barik and Swain (1976a) to explain the mixed results. Cummins had posited that a threshold of competence in the second language must be obtained before there are any apparent positive effects of bilingualism on cognition. Thus, the authors concluded that only the high achieving French students had reached a sufficiently high level of competency to reap cognitive benefits.

Duncan and De Avila (1979) found further support for Cummins' (1976, 1978, 1987) threshold theory in a comparison of four Spanish groups who differed in their relative bilingual proficiency and a monolingual group. Tasks included the *Cartoon Conservation Scales*, a measure of Piagetian conservation concepts; as well as the *Draw-A-Person Test* and *Children's Embedded Figures Test* as measures of field dependency. The proficient bilingual group outperformed the monolingual children on two of the three dependent measures. Among the bilingual groups, the degree of bilingual proficiency of each predicted their relative success. Duncan and DeAvila concluded that after the attainment of a minimum threshold of bilingual competency, bilingualism fosters cognitive growth. Hakuta et al. (1986) cautioned, however, that an IQ confound exists in the design of the Duncan and DeAvila (1979) study: the relative proficiency of the bilingual groups on the experimental tasks could be the result of simple groups differences in intelligence.

Landry (1974) looked at Foreign Language in the Elementary School (FLES) program and non-FLES students in an intact group comparison on the *Torrance Tests of Creative Thinking*, as a measure of divergent thinking skills. While no significant differences were seen at grade one or four levels, at grade six a significant effect was noted. Although the author gave no information about the proficiency of the grade six FLES children, the results appeared to indicate that after small amounts of traditional daily instruction in a second language,

the FLES children had reached a threshold level of competency by grade six.

In view of Cummins' threshold of competency theory (1976, 1978, 1987), Samuels and Griffore's 1979 New York State comparison of French immersion students in a K-1 classroom and regular program controls was similarly interesting. At the end of first grade the immersion children demonstrated a significant pretest to posttest gain in performance IQ and the picture-arrangement and object-assembly subtests named by the authors as measures of cognitive flexibility. After just one year the children had reached levels of competency in French that were adequate to foster cognitive skills according to the model proposed by Cummins (1976, 1978, 1987).

In Cummins' (1976, 1978, 1987) model, the threshold of competency needed to demonstrate cognitive gains is not absolute, but may vary both with the amount of exposure to the second language and the kind of cognitive operations that must be expressed through it. First grade children such as those in the Samuels and Griffore (1979) study are beginning to interact with their environment at the level of concrete operations, and are less dependent on the mediation of language than at later grades. Thus, the threshold for a first-grade child is lower in absolute terms than the threshold for a sixth-grade child, who would be leaving concrete operations and entering the stage of formal operations where symbolic language would become more useful. In this way, first-grade children in an immersion program may

reach a level of competency adequate to operate on their environment in the second language. This interpretation would then explain the Samuels and Griffore (1979) results in terms of Cummins' (1976) perspective.

A second theoretical interpretation of the Samuels and Griffore outcome is available, however. Hakuta, Ferdman and Diaz (1986) pointed to the positive effects of the initial stages of second language acquisition in stating that "some effects of bilingualism might occur as a result of the initial struggles and experiences of the beginning second-language learner" (p. 24). This assertion is supported by Diaz (1985) in a study of Spanish-English bilingual kindergarten and first grade children in an additive-bilingual program. High achieving English (second-language) subjects were compared to low achieving English (second-language) children on a number of visual and verbal tasks, including Ravens *Coloured Progressive Matrices*. A multiple regression analysis revealed that the level of bilingual proficiency of the low English achieving group significantly predicted a large portion of variability in cognitive measures within that group. The author concluded that the level of bilingual achievement was related to cognitive gains only *before* a threshold of competency in the second language, a reversal of Cummins' (1976, 1978, 1987) hypothesis. "If researchers want to understand how and why bilingualism affects cognitive development, studies should focus on children who are at the initial stages of the second-language acquisition process" (p. 1387).

A later report by Hakuta (1987) on the same longitudinal study confirmed the interest in the early stages of bilingualism as a focus of study. Beyond kindergarten and first grade, the correlations between bilingualism and outcomes of the Raven's no longer were significant.

Carey (1984) questioned a causal link between bilingualism and cognitive gains on methodological grounds. "No study to date has demonstrated that bilingualism produces cognitive advantages that cannot be questioned on grounds of student selection, parental or teacher attitudes, or other obvious sociocultural inequalities between comparison groups" p. 253. Hakuta's research (Hakuta, 1984, 1986, 1987, Hakuta & Diaz, 1985, Hakuta, Ferdman & Diaz, 1986), however, avoids the pitfalls of sociocultural inequalities in subject selection by looking at the cognitive ability of high and low second-language achievers within a single bilingual sample. Ferdman and Hakuta (1985) noted that such use of a single sample would not require assumptions about the equivalence of control and experimental groups on demographic factors.

A further attempt to look at the impact of bilingualism on cognition *within* a single population has been reported by Rueda (1984). Working with Whitaker and Prieto, Rueda compared three groups of mildly retarded 7 and 8 year olds who varied in their degree of bilingual achievement on two neo-Piagetian tasks and an information processing task. The high-achievement bilinguals outperformed both the low-achievement bilinguals and the

monolinguals. The author concluded that degree of bilingualism was significant in the attainment of the cognitive benefits of bilingualism, even among a special population of mildly handicapped children.

Recent cross-cultural investigations into the relationship between bilingualism and cognition also have attempted to control for sociocultural inequalities between bilingual and monolingual comparison groups. Three reports from India (Mohanty and Babu, 1983; Pattnaik & Mohanty, 1984; and Mohanty & Das, 1987) compared monolingual and bilingual groups of children from a common culture, the Kond tribal society in Orissa. The authors explained, "bilingualism among the Konds thus provides a unique setting for the study of the effects of a second language, since, unlike other bilingual and monolingual populations most often studied, the Konds belong to the same culture and socioeconomic condition regardless of the language difference" (1983, p. 18.). In each study, the bilingual and monolingual groups were equated on educational and economic status. Only balanced bilinguals participated. Two of the studies (Pattnaik & Mohanty, 1984; Mohanty & Babu, 1983) looked at children attending school. Results indicated significant differences on tests of metalinguistic ability in favor of the bilingual groups, but no differences in nonverbal intelligence, as measured by Raven's *Progressive Matrices*.

In the third study (Mohanty & Das, 1987), unschooled 7 and 9 year olds participated. The outcomes were reversed from earlier

reports with significant differences in favor of the bilingual children found on the Raven's, and no differences on tests of metalinguistic skill. The contrast in outcomes on the measures of metalinguistic abilities between the first two studies and the third were interpreted by the authors to reflect the impact of schooling on the development of metalinguistic abilities. The finding of significant differences in favor of the bilingual 7 and 9 year olds on the Raven's was not interpreted. The social-psychological nature of bilingualism makes the outcomes of these three *ex post facto* studies difficult to tease apart. As McNab (1979) noted, even when natural groups groups of bilinguals and monolinguals are equated on SES and age, it is impossible to rule out the presence of variables other than bilingualism which may be responsible for differences in cognitive development. Here, the issue is clouded by uncertainty as to social forces that presumably have worked to maintain the Kui language among bilinguals in the predominantly Oriya culture.

Thus, in summary, research since 1962 has demonstrated generally positive cognitive gains among certain bilingual groups. Consistent with the social-psychological nature of the bilingual experience, it is important to note that the majority of the studies cited involve additive-bilingual settings, where the acquisition of a second language in no way threatens or retards the development of native language skills. These outcomes are consistent with the development of contemporary theory, which seeks to explain gains in nonverbal

problem solving through the use of superior self-regulatory functioning, possibly the use of some form of verbal mediation.

Native Language Development

The primary and second-language development of children in bilingual settings were seen by Cummins and Swain (1986) to be surface manifestations of an underlying linguistic competence. The developmental-interdependence hypothesis of Skutnabb-Kangas and Toukomaa (cited in Cummins, 1978a) predicts that in additive-bilingual settings there will be no retardation in first language skills as the result of intensive exposure to a second language. Cummins and Swain clarify: *"To the extent that instruction in Lx is effective in promoting proficiency in Lx, transfer of this proficiency to Ly will occur provided there is adequate exposure to Ly (either in school or environment) and adequate motivation to learn Ly"* (italics in original).

In terms of immersion children, Cummins (1978a) noted that the students are from middle-SES families, and thus come into kindergarten with adequate levels of first-language development. Further, Lapkin and Swain (1984) pointed to their membership in the dominant linguistic group, which insures that English pervades all of their out of school life. Thus, as Gray (1986) observed, the native language skills of immersion children develop at the same rate whether the students are in the immersion program or not. In addition, Lambert & Tucker (1972) claimed that positive transfer across

languages may occur, increasing a child's vocabulary and understanding of linguistic complexities.

The social-psychological nature of bilingualism requires that investigators look closely at the setting in which a second language is acquired. In an additive-bilingual setting (Lambert, 1984) second-language competence is added to and complements first-language development. In contrast, subtractive bilingualism is experienced by many minority language children: the second language develops and eventually replaces competence in the first language, leaving a minority-language child with low levels of competence in both languages.

Results of evaluations of Canadian immersion programs show either that there is no difference in native-language development (see Barik & Swain, 1975a; Barik & Swain, 1976; Bruck, Lambert, & Tucker, 1974; Gray, 1986; Lambert, Tucker & d'Anglejan, 1973; Swain, Lapkin & Andrew, 1981) or that there is an initial lag in literacy skills that is corrected soon after introduction of English language arts instruction (see Genesee, Holobow, Lambert, Cleghorn & Walling, 1985; Barik & Swain, 1975b; Barik & Swain, 1976b; Shapson & Day, 1982). Further, Lapkin and Swain (1984) and Swain, Lapkin and Andrew (1981) observed that after grade four some immersion groups significantly outperform controls in certain English language arts skills.

Evaluations from the United States are equally encouraging. Genesee (1985) noted that immersion programs in Cincinnati, Ohio,

and Montgomery County, Maryland reported no retardation in English language development. Culver City, California, Spanish-immersion students were reported by Campbell (1984) to have demonstrated a higher stage of language development than their English-language peers on certain measures of vocabulary, comprehension, and expression. Cohen (1974) further observed that Culver City immersion students were also judged to be superior at English story telling.

Thus, evaluations of immersion programs support present theory that native-language development is not affected by the acquisition of a second language in an additive-bilingual setting. Research appears to confirm the existence of a common underlying linguistic proficiency that supports the development of both native and second languages in the bilingual child.

Attitude

What is the effect of becoming bilingual on a child's attitudes toward the second language group? Lambert (1980) questioned whether getting to know about another community and its language helps foster improved attitudes toward that group, or if a child must get to know the members of the second language community on a deeper level, through frequent interactions.

The question is of particular social relevance in Quebec, where, as Genesse (1984a; 1984b) noted, relations between English-Canadian and French-Canadian groups have been strained; and in areas of the United States where, according to Cohen (1974), better relations

between Spanish-speaking and Anglo students are sought. Further, the nature of the effect of bilingualism on attitudes is an important theoretical question.

Gardner (1983) posited a Socio-educational Model of Second Language Acquisition in which second language learning is a social psychological experiment involving groups, language, communication, the possibility of behavioral changes,and attitudes. Gardner's model proposes that the second-language learning process has both linguistic and non-linguistic outcomes, and among the non-linguistic outcomes are attitudes toward the second language community.

According to Genesee (1984a) acquiring a second language may result in a kind of cognitive restructuring. First,as Lambert (1980) noted, stereotyped attitudes are thought to be maintained where an individual is unfamiliar with that ethnic group. Increased familiarization by exposure to the other group alone allows an appreciation of that group's unique and shared characteristics. The increased differentiation may then lead to more positive attitudes. Students in an additive-bilingual program such as immersion may become more familiar with the second-language group through the models provided by their teachers or vicariously through their language studies (see Cziko, Lambert & Gutter, 1979; Genesee, 1984a; Lambert, 1987). Thus, according to Peal and Lambert (1962), language use may be a way of personally participating in a culture.

Second, as Genesee (1984a) pointed out, individuals may change their self-concept as they acquire a second language by internalizing the distinctive linguistic traits of another community. In an effort to maintain a consistently positive self-image the individual then projects positive attitudes toward the second-language group. This hypothesis is supported in Genesee, Tucker and Lambert's (1978) comparison of children from grades 1 to 5 in a standard (English) program, a French-immersion program, and a partial French-immersion program. Results indicated that children in the total immersion group saw themselves as more similar to all ethnic groups represented in a doll-selection task than did the standard program or partial immersion children ($p < .06$). The authors concluded that the immersion children generally identified more with the second-language ethnic group although results had not reached significance.

Cziko, Lambert and Gutter (1979) examined the attitudes of fifth and sixth grade early immersion and partial immersion students, as compared to English-program and French-program children. Subjects were presented with 45 pairs of concepts such as "monolingual English Canadians" and "bilingual French Canadians" and asked to measure their perceived similarity along a nine-point scale. Results indicated that the early immersion children saw significantly more similarity between themselves and bilingual French Canadians than did the other Anglophone students. Further, a trend was noted to generalize this similarity to monolingual French Canadians. The authors

concluded that learning a second language appears to narrow the perceived social distance between groups, and thus "becoming bilingual reduces the effects of ethnicity to some extent"(p. 26).

The attitudinal outcomes of immersion programs have been mixed (see Cziko, Lambert & Gutter, 1979; Genesee, 1984a; Lambert, 1980). However, many positive attitudes have been reported in immersion programs both in Canada and the United States (see Campbell, 1984; Cohen, 1974; DeLorenzo & Gladstein, 1984; Shapson & Day, 1982; Swain, 1984). Further, according to Lambert (1980, 1987) there have been no instances where immersion children had less favorable attitudes than the controls.

In the early years of the St. Lambert experiment, Lambert (1987) noted, the immersion children demonstrated significantly more positive attitudes towards French Canadians than did the English control group. Results were not so encouraging in later reports (see Lambert, Tucker, & d'Anglejan, 1973). In the fifth year of the St. Lambert experiment, grade four children gave themselves, French Canadians, other English Canadians, and European French people ratings on a series of bipolar personality traits. Immersion students, English-Canadian controls and French-Canadian controls participated. All three groups were essentially alike in their perception of French-Canadians, indicating that the immersion experience had had no differential effect on the St. Lambert children. However, the immersion children did see the French Canadians as being significantly

more pleasant than did the English-Canadian controls. This outcome was considered especially important because of the social-historical context of the study.

The grade five groups participating had an attitude profile that was intermediate between those of the French-Canadian and English-Canadian controls in their attitude toward French Canadians. However, only on the calm-emotional scale were the attitudes of the immersion children significantly more positive than those of the English-Canadian controls. The authors concluded that "we are talking about a small and selective difference of attitude, not at all a generalized identification and endorsement of the other ethnolinguistic group" (Lambert, Tucker & d'Anglejan, 1973, p. 150).

Thus, the more positive attitudes revealed in the earlier years of the St. Lambert experiment were no longer evident by grade five. The authors noted that the children's stereotypic attitudes at grade five may have been the result of the program site having been moved to a school where a nonrepresentative sample of lower-SES French-Canadian students were in playground contact with the immersion children.

Genesee (1983) came to an opposite conclusion, however. Passing over the issue of playground contact, he looked to the general issue of sustained interaction between linguistic groups. The immersion children even in Quebec have been noted by Genesee (1984a) and Lambert (1980) to have little meaningful contact with the

French-Canadian community. Genesee questioned the ability of immersion programs to sustain positive attitude changes in the absence of meaningful contact with the second-language community. Vicarious contact with another group may not be enough; children need to interact with likable members of the other linguistic community. Supporting this hypothesis are data which reveal that students in a French-immersion program in an otherwise all-French school showed more positive attitudes toward French Canadians than students in French-immersion programs in English schools, according to Genesee (1983; 1984a).

Gardner (1983) also questioned the ability of second language learning alone to affect changes in attitude toward another linguistic group. He pointed to the experiences that children encounter as the result of having new second language skills as the possible source of attitudinal change, but cautioned that there is no guarantee that such experiences will be favorable. Gardner thus called for more research.

In conclusion, information coming from immersion programs indicates that immersion education seems to foster positive attitudes toward the second language group. However, positive attitudes may not be sustained in the absence of meaningful interaction between the immersion children and the second-language community.

This study sought to investigate the impact of the early stages of bilingualism on the cognitive and attitudinal development of children enrolled in a Spanish-immersion program that is geographically

isolated from a Hispanic community. A second-grade Spanish-immersion program in a suburban school district in the state of Washington was compared longitudinally to a standard second-grade program in the same community, on measures of nonverbal problem-solving abilities, attitudes, and native language development. The first hypothesis of the study was that the second-grade Spanish-immersion students would make positive gains (alpha = .05) over the monolingual control group on a measure of nonverbal problem-solving. Second, it was expected that the Spanish-immersion children would be more positive than the standard-program control group on a measure of attitudes toward the Mexican-American culture. Finally, as majority-language students, the Spanish-immersion children were expected to show no significant differences in native-language development from the standard program control group on a measure of receptive English vocabulary.

Subjects

Subjects selected for this study were 19 members of an intact Spanish-immersion second-grade class (8 boys and 11 girls) and 19 members (11 boys and 8 girls) from a standard-program second-grade class located at another school of comparable socio-economic and educational status. During the course of the school year, one child in the control group moved out of state, thus in the second phase of the study the control group was composed of only 18 members (10 boys and 8 girls).

In the spring, 22 members of the remaining second-grade Spanish-immersion class (10 boys and 12 girls) were brought into the study to facilitate a within-group comparison of the Spanish-immersion children. The mean age of the children participating was 7 years, 9 months. There were no significant gender or age differences among the three classrooms. Further, no native speakers of Spanish or children with speech or hearing disabilities were found in any classroom.

Instrumentation

The *Coloured Progressive Matrices* (CPM) (Raven, 1977) provided a measure of nonverbal problem-solving ability. As Hakuta and Diaz (1985) noted, the test is a commonly used and reliable measure, and according to Raven (1977) it assesses all the perceptual reasoning processes that are generally found in children under 12 years of age. The test requires a child to analyze, in Diaz' (1985) words "a whole in its perceived elements and then to compare and coordinate analogous changes in those elements" (p. 1380). Thus, as Ben-Zeev (1977b) pointed out, the CPM requires the child to pay attention to two dimensions of a system simultaneously. In this way, the CPM calls on a child's ability to control cognitive processing. Kirby and Das (1978) considered the CPM to be culture fair and independent to acquired knowledge and verbal skills, although others believe that acquired skills may be involved. Test-retest reliability for the CPM ranges from .86 to .90, and the internal consistency of the test performances is high:

.64-.83, as reported by Raven (1977). The CPM was used both as a measure of cognitive flexibility and as a measure of nonverbal intelligence in the evaluation of the St. Lambert Experiment (see Lambert & Tucker, 1972; Lambert, Tucker & d'Anglijan, 1973). Further, the CPM was used as a measure of system analysis in Ben-Zeev's (1977b) study of metalinguistic awareness, and as a test of nonverbal intelligence in a study of a Spanish-English additive-bilingual program in New Haven, Connecticut (Diaz. 1985; Hakuta, 1984, 1985, 1987; Hakuta & Diaz, 1985; Hakuta, Ferdman & Diaz 1986)

The *Peabody Picture Vocabulary Test-R, Form L,* (PPVT-R) (Dunn, Dunn, Robertson & Eisenburg, 1981) was chosen as a test of native-language development. The PPVT-R is an individually administered test of receptive English vocabulary which has a split-half reliability correlation range from .73 to .84 for the target age group according to the authors (Dunn, Dunn, Robertson & Eisenburg, 1981). In evaluations of immersion programs in Canada, the PPVT has been used in the St. Lambert experiment (see Bruck, Lambert & Tucker, 1974; Lambert & Tucker, 1972; Lambert, Tucker & d'Anglejan, 1973) and in Fredericton, N.B. (Gray, 1986). In each instance the PPVT was used as a measure of language development.

In the spring, the Spanish version of the PPVT-R, *Test de Vocabulario en Imagenes Peabody* (TVIP) (Dunn, Padilla, Lugo & Dunn, 1986) was also administered to the members of the Spanish-immersion group. The TVIP is a test of receptive Spanish vocabulary,

the Spanish version of the PPVT that has been reordered for use in Mexican and Puerto Rican cultures. Split-half reliability of the TVIP for children in the target age group is .94. All immersion children were tested individually in the English PPVT-R, and then tested individually in the Spanish TVIP after a delay of several days.

The *Cross-Cultural Attitude Inventory* (CCAI) (Jackson & Klinger, 1971) was used as a measure of attitude toward the Mexican-American culture. It is recommended by the authors for children between the ages of 3 and 18 to assess the degree of positive or negative feelings which they hold toward the Mexican-American and Anglo cultures. In the fall, the test was administered in Spanish and English (standard procedure) to the immersion children, and in English only to the monolingual control group, in groups of four children. In the spring, the CCAI was administered individually, and half of the Spanish-immersion students were tested in English only.

According to Klinger (personal communication, November 18, 1987) reliable norms for children are not available at this time for the instrument; thus the CCAI is recommended only for research use. The validity of the CCAI is based on face validity and the rationale that the authors used in both item selection and construction procedures. Content validity is based on an estimation of how well the symbols used actually represent Anglo and Hispanic cultures. The CCAI was used in the evaluation of the Culver City, California, Spanish-

immersion program, as well as a Title VII bilingual education program in Redwood City, California (Cohen, 1974).

Design and Procedures

Program was the independent variable in three comparisons made in the fall, and again in the spring of 1987-88. In the first comparison, nonverbal problem-solving ability was the dependent variable as measured by the CPM. In the second comparison, attitude was the dependent variable as measured by the CCAI. Finally, the dependent variable of the third comparison was the PPVT-R.

In the spring of 1988, three within-group comparisons were made among the immersion children. Spanish achievement as measured by the TVIP was the predictor variable in the first comparison, with nonverbal problem solving ability as measured by the CPM as outcome. In the second comparison, Spanish language development as measured by the PPVT-R was the predictor variable, with English achievement as measured by the TVIP as the outcome measure. Finally, the predictor variable of the third comparison was Spanish achievement as measured by the TVIP, with attitude toward the Hispanic culture as the outcome variable.

Results

Nonverbal Problem-Solving

An analysis of covariance was performed on the outcome of the CPM with gender, age, and the results of the PPVT-R as covariates. In the fall and spring, no significant differences were revealed between the

immersion and control classrooms, $p > .05$. For means and standard deviations, see Table 1.

Insert Table 1 about here

However, a repeated-measures analysis of variance of the results of the fall and spring administrations indicated a significant difference in favor of the Spanish-immersion group, $F\ (1, 35) = 5.557$, $p < .05$. See Table 2 for an analysis of variance summary.

Insert Table 2 about here

In the spring, the relationship of degree of bilingualism to performance on the CPM among immersion children was examined. Spanish achievement was the independent variable, with spring results of the CPM as the dependent variable. Results of a simple regression analysis were significant, adjusted $R^2(40) = .20$, $F\ (1,39) = 10.72$, $p < .00$.

Attitude

The symmetrical nature of the CCAI instrument allowed a repeated-measures multivariate analysis of covariance to be performed on the fall results of the CCAI with gender, age, and the results of the PPVT-R and CPM as covariates to control for verbal skills and nonverbal problem-solving ability. For means and standard deviations, please see Table 3.

Insert Table 3 about here

A significant effect was shown in favor of the immersion classroom, F (3, 107) = 48.02, $p < .05$. For an ANOVA summary, see Table 4.

Insert Table 4 about here

In the spring, a repeated-measures analysis of variance also revealed significant differences, F (1, 56) = 8.801, $p < .05$ between the two groups in favor of the immersion classroom. For an analysis of variance summary, see Table 5.

Insert Table 5 about here

A repeated-measures analysis of variance of the children's attitude toward the Anglo culture failed to reveal a significant difference between fall and spring administrations, $p < .05$. However, the same test applied to attitude toward the Hispanic culture revealed a significant change between administrations in favor of the immersion group, F (1, 35) = 4.177, $p < .05$. See Table 6 for a summary of the ANOVA data.

Insert Table 6 about here

A within-group comparison of immersion children was made in the spring, with language of administration (Spanish and English) as the independent variable, and attitude toward the Hispanic culture as measured by the CCAI as dependent variable. No significant differences were found due to language of administration, $p > .05$. Also, in the spring the high and low Spanish-achievement groups of immersion children were compared on the CCAI. Results indicated no significant differences in attitude between the achievement groups, $p > .05$.

Native-Language Development

An analysis of covariance was performed on the fall and spring results of the PPVT-R with the outcomes of the CPM, gender and age as covariates to control for intellectual ability. For means and standard deviations, see Table 7.

Insert Table 7 about here

No significant differences between the control and immersion-program groups were found, $p > .05$. The relationship of degree of first and second language skill was investigated using regression analysis on the

outcomes of the PPVT-R and the TVIP. Results were significant, adjusted $R^2(40) = .17$, $F(1,39) = 8.94$, $p < .01$.

Discussion

Nonverbal Problem Solving

The significant gain in nonverbal problem solving demonstrated by the immersion children over the control group after the course of the school year supports findings of positive cognitive changes by Bruck, Lambert and Tucker (1974) among immersion students in the original immersion program in St. Lambert, Quebec, Canada; and by Samuels and Griffore (1979) in their study of New York State French-immersion children. Also supported are findings of positive cognitive changes among foreign-language students in a cross-sectional study by Landry (1974). Care should be used in interpreting the results of the present study, however. As McNab (1979) noted, in an *ex-post facto* design such as the one used here, even though the control and experimental groups are apparently balanced for SES and educational level, the fact that parents are willing to place their children in an immersion program indicates that they differ from parents of children in the standard program in some unspecified way that may possibly influence their children's cognitive development.

As Hakuta (1987) pointed out, the most interesting relationship between bilingualism and cognition appears to be found in the primary grades. Children in additive-bilingual settings who are simultaneously entering school, becoming literate, and acquiring a second language are

participating in three experiences that have been shown to enhance metalinguistic ability, one facet of which is cognitive control. It may be that the interaction of three such experiences at that particular point in development enhances control of cognitive processing and thus furthers the growth of symbolic thinking. A recent report by Hakuta (1987) suggests that the cognitive advantages of an additive-bilingual experience may attenuate in later grades. More research is needed to chart how the developmental path of symbolic reasoning among children in additive-bilingual settings may differ from that of their monolingual peers.

The significant relationship between degree of bilingualism and CPM scores within the immersion group is interesting in terms of Hakuta and Diaz' (1985) finding of positive cognitive changes on the same instrument among second-graders in an additive English-Spanish bilingual program. Both the findings of this study and those of Hakuta and Diaz (1985) appear to indicate that the degree of bilingualism attained is important in demonstrating positive changes in nonverbal problem-solving ability among bilingual children. Results here may also be interpreted in terms of Cummins' (1976, 1978, 1987) threshold of competence theory which asserts that cognitive gains will be seen among persons who attain higher stages of balanced bilingualism appropriate for their age.

Just how bilingualism may foster skill in solving nonverbal problems remains unclear. Further research seeking support for

Vygotsky's (1978) assertion that the mediation of language is an essential part of nonverbal problem-solving is needed among bilingual children.

Attitude

In terms of attitude, the immersion children were significantly more positive toward the Hispanic culture in relation to their attitudes toward the Anglo culture than their monolingual peers in both the fall and spring comparisons. This finding supports Gardner's (1983) model of second-language acquisition, which posits that attitudes toward the second-language community may be outcomes of the second-language learning process. However, the finding of no significant differences between high and low Spanish achievement groups on the CCAI does not support the notion that more positive attitudes are necessarily the result of high achievement.

In terms of language of administration, no significant differences were found within the immersion children on the spring administration of the CCAI between groups who received the CCAI in Spanish and English (standard administration) and English (administration revised for the control children). Thus, there is no support for the contention that differences between the immersion and control groups on the CCAI were the result of differences in language of administration.

Lambert's (1980, 1987) and Genesee's (1984) theory of the role of familiarization in breaking down stereotypes of another ethnic group,

as well as Genesee's (1984) explanation of attitude change as the result of changing self-concept in the course of second-language acquisition were also supported by the outcomes of this investigation.

The findings of positive attitudinal changes toward the second language community replicate the findings of a comparison of Spanish-immersion and control children in Culver City, California, on the CCAI that was reported by Cohen (1974). Further, the findings are consistent with those reported by Lambert and Tucker (1972), where at the end of first grade the immersion children viewed French Canadians more favorably than did the English control group.

This comparison was motivated by the question of whether the acquisition of a second language would foster improved attitudes toward the second-language group in a setting where the children live in geographic isolation from the second-language community. The results here support such a hypothesis. Even in the absence of interaction with a Spanish-speaking community outside of school, the immersion children demonstrated more positive attitudes toward the Mexican-American culture.

Caution should be exercised in the interpretation of these results, since the fact that the parents of the Spanish-immersion children chose to place them in the program presumably would indicate their positive attitude toward the Hispanic culture. The children's attitudes may partially be a reflection of those they encounter at home.

The results of the repeated-measures comparison of attitude-to-Anglo culture between the immersion and control classrooms showed no significant change over the course of the school year, while the attitude to the Hispanic culture scores were significant indicating the influence of the Spanish-immersion program on attitudes toward the second-language culture. However, Gardner's (1983) observation is pertinent: while immersion programs may foster improved attitudes, such attitudes would depend on the type of experiences immersion children encounter, positive or negative. Further, the positive changes in attitude shown in this study may not be sustained in the absence of meaningful interaction between the immersion children and the second-language community.

Native Language Development

As had been expected, the measure of native-language development did not differentiate between the Spanish-immersion and control groups. Children in additive-bilingual settings seem to develop native language skills on a par with their monolingual peers in spite of being educated in a second language. Further, the developmental-interdependence theory cited by Cummins (1978) is also supported, as well as Lambert's (1984) concept of "additive-bilingual" settings.

The finding of a significant relationship between degree of proficiency in native and second languages among the immersion children supports Hakuta's (1987) notion of the role of the native

language as a foundation in second-language acquisition. These findings are compatible with Cummins' and Swain's (1986) theory of an underlying linguistic competence. However, as Hakuta (1986b, 1987) noted, language is many skills, not a single ability. The present study looked only at receptive vocabulary as a measure of native language development. Further research into other facets of language such as English syntax development among children in immersion settings is needed before a conclusion may be reached on the impact of being educated entirely in a second language.

The social-psychological nature of bilingualism limits inquiry into its consequences. The development of bilingual children varies with the unique mix of community, class and institutional settings in which the children are found. For children in an immersion program such as the one described here, the consequences of bilingualism are shaped by the additive-bilingual nature of the immersion setting. No generalizations should be made to other groups of children who may not be subject to the same social-psychological influences.

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Table 1

Means and Standard Deviations of Immersion and Control Group on the Raven's Coloured Progressive Matrices

	Immersion		Control	
	Fall	Spring	Fall	Spring
n	19	19	18	18
M	25	28.90	26.39	27.39
SD	4.87	4.58	5.81	4.84

Table 2

Analysis of Variance Summary for Nonverbal Problem-Solving as a Function of Program

Source	*SS*	*df*	*MS*	*F*
Program (A)	.06	1	.06	.002
subjects w. groups	1414.45	35	40.41	
Repeated Measures (B)	114.38	1	114.38	16.41*
Interaction (A x B)	38.73	1	38.23	5.56**
B x subjects w. groups	243.90	35	6.97	

* $p < .01$

** $p < .05$

Table 3

Means and Standard Deviations of Immersion and Control Group on the Cross-Cultural Attitude Inventory

		Immersion		Control	
		Anglo	Mexican	Anglo	Mexican
	n	19	19	19	19
Fall	*M*	42.79	41.42	43	39.68
	SD	6.22	5.69	7.38	5.25
	n	19	19	18	18
Spring	*M*	43.90	42.95	45.11	42.50
	SD	4.90	3.50	5.70	6.06

Table 4

Repeated Measures Multiple Analysis of Covariance Summary for Attitude toward Anglo and Hispanic Culture as a Function of Program, Fall Administration

Source	*SS*	*df*	*MS*	*F*
Within Cells	871.16	107	8.14	
Attitude	1172.97	3	390.99	48.02*
Group by Attitude	1000.55	3	333.52	40.96*

* $p = .001$

Table 5

Analysis of Variance Summary for Attitude toward Anglo and Hispanic Culture as a Function of Program, Spring Administration

Source	*SS*	*df*	*MS*	*F*
Program (A)	2.73	1	2.73	.07
subjects w. groups	1434.40	35	40.98	
Repeated Measures (B)	57.10	1	57.10	5.06*
Interaction (A x B)	12.79	1	12.79	1.14
B x subjects w. groups	394.61	35	11.28	

* $p < .05$

Table 6

Analysis of Variance Summary for Attitude toward Hispanic Culture as a Function of Program

Source	*SS*	*df*	*MS*	*F*
Achievement (A)	22.40	1	22.40	.654
subjects w. groups	1199.46	35	34.27	
Repeated Measures (B)	86.49	1	86.49	4.18*
Interaction (A x B)	7.90	1	7.90	.38
B x subjects w. groups	724.62	35	20.70	

* $p < .05$

Table 7

Means and Standard Deviations of Immersion and Control Group on the Peabody Picture Vocabulary Test-Form L

	Immersion		Control	
	Fall	Spring	Fall	Spring
n	19	19	18	18
M	112.90	111.95	112.89	112.28
SD	15.50	18.19	10.12	11.53

Table 8

Analysis of Variance Summary for Native-language Development as a Function of Program

Source	*SS*	*df*	*MS*	*F*
Program (A)	.49	1	.49	.00
subjects w. groups	12874.51	35	367.84	
Repeated Measures (B)	11.37	1	11.37	.28
Interaction (A x B)	.52	1	.52	.01
B x subjects w. groups	1407.61	35	40.22	